

— Anchors, chains and an absence of knees

Identifying the Boot Reef shipwreck

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In December 2018, a team of divers from the museum and Silentworld Foundation found an unidentified shipwreck on Boot Reef, a remote reef system some 950 kilometres north of Cairns and 100 kilometres east of Mer (Murray Island) at the eastern entrance to Torres Strait. Research and analysis of artefacts has now enabled the wreck to be identified.

By Kieran Hosty and Dr James Hunter.

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THE 2018 EXPEDITION TEAM discovered an iron stud-link anchor chain running west-east across Boot Reef, a large iron anchor lying on the reef top, and a second, smaller anchor off the reef's western edge precariously perched on a rock ledge in 39 metres of water (see 'Black reefs and the "Jardine Treasure"', *Signals* 126). As work progressed, more artefacts were uncovered, including copper-alloy hull fastenings and sheathing, iron chain plates, glass deck-light fragments, and copper-alloy fittings from rigging blocks.

As team members swam eastward across the reef top and followed the line of wreckage into curling breakers on the eastern side of the reef, they found a cluster of additional artefacts. These included unidentified iron concretions, iron rigging components and mast fittings, iron gudgeons and/or pintles (large hinges mounted on both the ship's stern and rudder upon which the rudder pivots), lead patches, additional copper sheathing fragments, several copper-alloy nails, spikes and bolts, and a number of large iron keel bolts. Small finds within the scatter included lead musket shot and sounding weights, as well as glass and coal fragments. But what did this all mean?

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At least 15 recorded
shipwrecks are
known to have
occurred within the
vicinity of Boot Reef

Silentworld Foundation Director John Mullen examines the stud-link anchor chain on Boot Reef. The anchor chain was the first indication that an unidentified early-19th-century shipwreck was present at Boot Reef.

Evidence – and its absence

Deliberately misquoting Carl Sagan, 'Is the absence of [archaeological] evidence [on Boot Reef] evidence of something's absence?' – or, is what is *not* present at the site equally important as what *is* present? In the case of the Boot Reef shipwreck, clues in the form of surviving material culture proved critical to narrowing the field of potential vessel candidates. However, it was not just what was present that helped solve the mystery of the site's identity. Surprising though it may sound, this evidence-based approach was complemented by the notable *absence* of specific artefacts and architectural components.

By the late 18th century, advances in the disciplines of naval architecture and ship design allowed shipbuilders, owners, insurers and underwriters to devise a series of rules and regulations governing the construction of wooden ships. When the dive team arrived back in Sydney, they consulted these rules and regulations and other contemporary references about ship construction and design and compared them with the archaeological material found at Boot Reef. Doing so enabled the team to systematically whittle down the list of potential shipwreck candidates and establish – with a fair degree of confidence – the identity of the site investigated in 2018.

The anchors

Each anchor discovered at Boot Reef exhibits a thin shank that would have been fitted with a wooden stock. This, coupled with a large iron ring and sharp crown formed by the arms, is consistent with what is known as an 'old pattern long-shanked' variant of the Admiralty-pattern anchor. Developed in Great Britain, this style of anchor was in common use aboard European vessels throughout the late 18th and early 19th centuries.

Both anchors at Boot Reef are later variations of this type, and each is fitted with an anchor ring rather than one or more iron shackles, which were first patented by Royal Navy Lieutenant Samuel Brown in 1808. These traits indicate that the wrecked vessel was most likely constructed and outfitted after 1808, but before 1830. Furthermore, each anchor's size indicates the tonnage of the vessel that would have used it. A comparison of the reef-top anchor's total length (3.81 metres) with information contained in early-19th-century treatises reveals an exact match with the largest anchors used aboard merchant ships of 330–360 tons.



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Anchor chain

While two anchors were discovered in association with the site, only one iron anchor chain (or cable) was located. It is paid out over the reef top and, based on the broken link at its western terminus, is almost certainly associated with the anchor located on the reef wall directly beneath it. The lack of a second anchor chain suggests that the reef-top anchor's cable was constructed from natural fibre such as hemp or manila.

Stud-link chain was first patented by Samuel Brown in 1808. While ship owners were cautious about adopting new technologies, stud-link anchor cables were carried as a matter of course on most European vessels by the mid to late 1830s.

Copper sheathing

For 2,000 years, shipbuilders have tried to protect the wooden hulls of their vessels from the ravages of timber-eating organisms such as 'shipworm' (*Teredo navalis*) and 'gribble' (*Limnoria* sp). Several solutions were proposed and tried, including patent compounds and paints, horsehair and sacrificial pine sheathing. By the mid to late 18th century, copper and copper alloy sheathing emerged as the most effective means of protecting wooden hulls.

Royal Navy warships were first clad in copper sheathing in the 1760s, and by 1777 the first British merchant vessels followed suit. The next major development in hull sheathing occurred in 1832, when an alloy of copper and zinc known as 'Muntz metal' or 'patent yellow metal' was developed. This proved ideal for covering ships' hulls, and by the mid-1840s was the most commonly used metal sheathing affixed to British and continental European vessels.

The Boot Reef shipwreck's hull sheathing appears to have been manufactured predominantly from copper rather than one of its alloys, and while by no means conclusive, its presence strongly suggests an early-19th-century date range.

The evidence indicates that the vessel was sailing on an easterly or northeasterly track when it struck the western edge of Boot Reef

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Copper-alloy fastenings such as these nails indicate that the vessel was probably built after 1810.

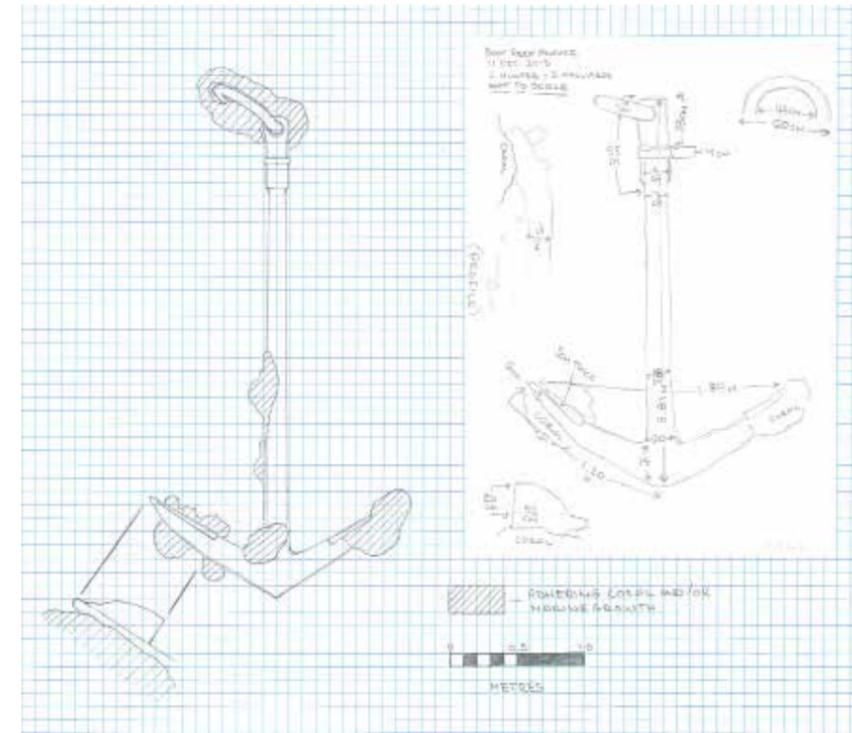
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Irimi Malliaros and Andrew White examine the edge of Boot Reef where the stud-link anchor chain terminates. Analysis of the chain and the anchor on the reef wall below it indicates the vessel struck the western edge of the reef.



Royal Navy warships were first clad in copper sheathing in the 1760s, and by 1777 the first British merchant vessels followed suit

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01 Maritime archaeologist Irini Malliaros and Silentworld Foundation diver Jacqui Mullen carry out a metal detector survey on Boot Reef. The metal detectors proved invaluable in locating metal artefacts covered by sand and coral debris.

02 Documenting and analysing the two anchors found on Boot Reef allowed the team to calculate an estimated age and tonnage for the mystery shipwreck. On the right is the original sketch of the reef-top anchor, and on the left the scaled drawing. Image James Hunter/ANMM

Iron rudder fittings

Among the artefact cluster on the reef’s eastern edge were three examples of mounting hardware for the vessel’s rudder. All were heavily concreted or damaged; consequently, it was difficult to positively discern whether they were gudgeons or pintles. The largest and best-preserved example has a maximum length of 1.27 metres, a width of 7.6 centimetres and a thickness of 2.5 centimetres. Based on information contained within *Lloyd’s Rules and Regulations* (1864), the dimensions of the best-preserved example compare favourably with that of a sailing vessel between 450 and 500 tons***.

The use of iron in the manufacture of the rudder hardware is highly unusual for a vessel built in Great Britain during the mid to late 19th century. Copper alloys were more commonly used to manufacture gudgeons and pintles during this period, while iron rudder hardware is generally more indicative of a vessel constructed during the late 18th or early 19th centuries. Iron pintles and gudgeons were also a common feature of 19th-century vessels built in the colonial shipyards of Canada.

Copper-alloy and iron ship fastenings

Ship fasteners ranged in size from small rose-headed copper-alloy sheathing tacks to large, heavily concreted iron keel bolts. These and other fastener types, including nails, spikes and dumps, were found scattered across the reef top. Beginning in the 1750s, European navies began experimenting with copper and its alloys as a suitable material for ship fastenings. Although more expensive and difficult to manufacture than those forged from iron, copper and copper-alloy fastenings resisted corrosion much better than iron.

By the mid-1770s, myriad patents for copper and copper-alloy ship fastenings existed. While the British and French navies could afford to use copper fastenings and sheathing on their ships, merchant fleets could not, and the use of copper sheathing and copper-alloy fasteners remained limited for the remainder of the 18th century.

Although by no means conclusive, the presence of a mix of both copper-alloy and iron hull fastenings suggests that the wrecked vessel was constructed during a transitional phase when iron fasteners and fittings were gradually superseded by those manufactured from copper and its alloys. This phase commenced around 1800 and continued until the 1820s, when copper and its alloys became the predominant metals used in wooden ship construction.

But where are the iron braces?

Given relatively rapid advances in naval architecture in the 19th century, iron structural components became a common feature of vessels built in Great Britain and continental Europe. Not surprisingly, iron elements of ship architecture are frequently found in association with 19th-century shipwrecks on the Great Barrier Reef and in the Australian Coral Sea Territory. It is extremely unusual, then, that no iron knees or other forms of ferrous ship architecture are present at Boot Reef.

In North America, where shipbuilders had access to vast supplies of local timber, the use of iron braces such as knees, crutches and breasthooks was kept to a minimum and few American ships were fitted with iron knees during the early to mid 19th century. Surveyors from Lloyd’s of London enforced the insurer’s classification standards and rules, and greatly influenced how ships were built in British colonies – particularly if shipowners wanted to sell to European buyers. Lloyd’s actively discouraged the use of softwoods such as pine and spruce in the construction of ships, and downgraded the insurance rating for vessels built from these timbers.

To get around this problem, Canadian shipbuilders began installing iron knees in vessels constructed at shipyards in New Brunswick and Quebec from 1811 onwards. By the mid-1820s, Lloyd’s had amended its *Rules and Regulations* for colonial vessels to stipulate that they must ‘be secured in their bilges by the application of iron riders’ to receive an ‘A’ rating.¹ Further, additional bolts were to be used, and all ships were to be ‘secured by iron-hanging knees to the hold beams.’² As a result, iron knees became standard on New Brunswick-built vessels, most of which were retrofitted in England prior to sale.

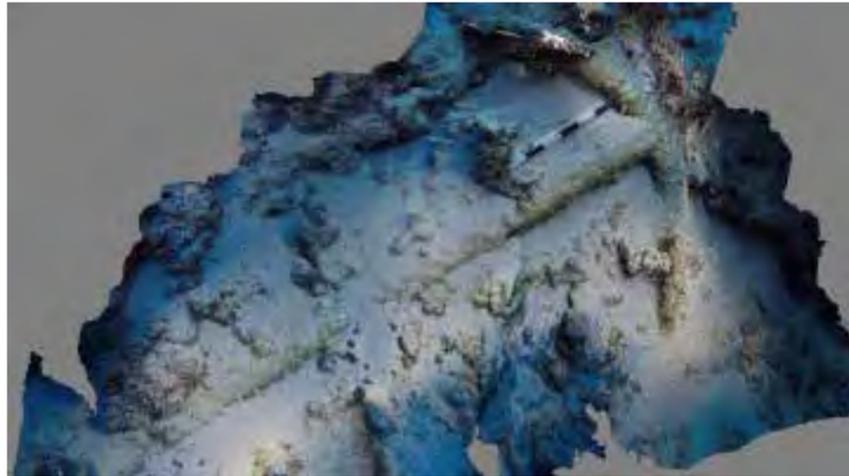
The presence of iron knees on shipwreck sites in Australia normally indicates a build date from the late 1820s onwards. The absence of iron knees or other ferrous architectural elements on the Boot Reef shipwreck strongly suggests it predates 1830. Further, it can be argued that it may represent a North American-built vessel that was either registered to an American owner, or a British owner that had not yet retrofitted it according to Lloyd’s regulations.

*** Question for Kieran: Is this the tonnage range for rudder hardware of this type, given it falls a bit outside the 200 - 400 ton range mentioned in the conclusion?

The wreck of the *Henry*, a former female transport, is both Australia's earliest known shipwreck of a Canadian-built vessel, and the oldest wreck site of a convict ship identified to date

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3D model of the smaller anchor located in deep water off the western edge of Boot Reef. Image James Hunter/ANMM

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Museum maritime archaeologist Dr James Hunter examines an iron gudgeon or pintle found on the eastern edge of Boot Reef. The presence of iron rudder hardware strongly suggests the wreck is that of an early-19th-century vessel built in North America.



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A candidate emerges

Archaeological investigation of the Boot Reef shipwreck revealed it to be the remains of a wooden-hulled merchant sailing vessel between 200 and 400 tons burthen. Aspects of its construction, including copper sheathing and a mix of iron and copper-alloy fasteners, indicate a likely build date between 1800 and 1830. The vessel's proposed date range and size are reinforced by the two anchors, and presence of only one iron anchor chain. Furthermore, the presence of iron rudder fittings and absence of iron knees and other ferrous internal bracing suggests the vessel was most likely built in North America during the first two decades of the 19th century.

Spatial analysis of the artefact scatter, as well as distribution of the two anchors and run of chain, indicates the vessel was sailing on an easterly or northeasterly track when it struck the western edge of Boot Reef. The crew appears to have deployed the smaller anchor first, and fitted it with the iron cable. In all likelihood, the stern extended over the edge of the reef at the time the anchor was let go, and this would account for the anchor's precarious position on the reef wall. The vessel then appears to have surged across the reef flat, causing the attached chain to pay out. Ultimately, the chain broke and the second anchor – fitted with hemp or manila cable – was deployed.

The vessel continued to surge eastwards, about three-quarters of the distance across the reef, then came to rest and began to break up in the surf. Ship fasteners, deck lights, copper sheathing, chain plates and mast hardware were all deposited on the reef top as the timber hull started to work apart. The dispersal of material culture from west to east, rather than from south-east to north-west, also suggests the wrecking event occurred during the northern Australian wet season, which runs from January to April. During this period, winds in the Torres Strait blow predominantly from the west. By contrast, Boot Reef is under the influence of strong southeasterly trade winds between the months of May and December.

According to the Australasian Underwater Cultural Heritage Database, at least 15 recorded shipwrecks are known to have occurred within the vicinity of Boot Reef. Based on a review of existing archaeological and historical data, including construction attributes, vessel size, site formation features and historic weather patterns, most of these candidates have been removed from consideration. Of the entire list of potential candidates, the English-built brig *The Sun* (1826) and Canadian-built ship *Henry* (1825) exhibit size and

construction attributes that most closely match the shipwreck at Boot Reef. However, *The Sun*, at only 185 tons, is too small to have carried both anchors associated with the site. Additionally, it wasn't large enough to have been outfitted with the wreck's rudder hardware.

Based on available archaeological and historical data, the likeliest candidate for the Boot Reef shipwreck is *Henry*. The Quebec-built vessel entered service in 1819 and was fitted with spruce knees instead of iron internal bracing. At 386 tons, its size most closely approximates that for a vessel outfitted with the anchors, chain and rudder fittings observed on the wreck site. *Henry* was lost in 1825 on an unnamed reef in the vicinity of Torres Strait while sailing northbound from Sydney to Batavia. It had dropped female convicts at Hobart and was returning to England. No casualties were reported. The loss occurred in April, when Boot Reef is primarily subject to westerly winds, and this correlates well with the shipwreck's proposed site formation scenario.

While the team may not have discovered a 'treasure wreck', its detective work has revealed a site of arguably greater historical and archaeological value: a former female transport that is both Australia's earliest known shipwreck of a Canadian-built vessel, and the oldest wreck site of a convict ship identified to date.

Footnotes to come - Kieran to supply

References

- Australian Lloyds, 1864, *Rules and Regulations, with Registration Tables Applicable to the Varieties of Colonial Timbers Used in Shipbuilding, Scale of Fees, &c.* Mason & Firth, Melbourne.
- Curryer, B, 1999, *Anchors: An Illustrated History.* Chatham Publishing, London.
- Fincham, J, 1825, *An Introductory Outline of the Practice of Shipbuilding, &c* (second edition). William Woodward, Portsea.
- Hosty, K, J Hunter, I Malliaros and P Hundley, 2019, 'Black reefs and the 'Jardine Treasure': The Boot Reef Project 2018', *Signals* 126, pp 8–25.
- McCarthy, M, 2005, *Ships' Fastenings: From Sewn Boat to Steamship.* Texas A&M University Press, College Station.
- Staniforth, M, 1985, 'The Introduction and Use of Copper Sheathings: A History', *Bulletin of the Australian Institute of Maritime Archaeology* Vol 9 No 1, pp 21–32.
- Steel, D, 1794, *The Elements and Practice of Rigging and Seamanship, Volume One.* David Steel, London.
- Trill, T W, 1885, *Chain Cables and Chains.* Crosby Lockwood and Co, Ludgate Hill (London).